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Citrus tree performance under a soil-applied fertilizer program supplemented with foliar nutrition

Foliar feed your trees

By Mongi Zekri

Foliar fertilizer application is certainly not a new concept to the citrus industry. For over six decades, foliar fertilization has been recommended to correct zinc, manganese, boron, copper and magnesium deficiencies in citrus. It is now common knowledge in agriculture that properly nourished crops may tolerate insect pests and diseases. Traditionally, citrus growers try to achieve optimum nutrition through direct soil management. Currently, with citrus greening in Florida, many growers and production managers consider foliar fertilization a key factor to stimulate the natural defense mechanisms of their trees, to induce pest and disease tolerance, and to improve fruit yield and fruit quality.

In Florida, foliar nutrition programs are becoming very common and extensively used to deliver essential nutrients to citrus trees. Furthermore, economic and environmental considerations require the utilization of more efficient methods for nutrient applications. Foliar application of fertilizers can result in rapid nutrient uptake and reduced losses. Although field research has shown that supplemental foliar feeding can increase yield by 10% to 25% compared with conventional soil fertilization, foliar fertilization should not be considered a substitute for a sound soil fertility program.

Foliar fertilizer application is highly efficient because the materials are targeted to areas where they can be directly absorbed into the plant. However, foliar-applied nutrients prior to a rainfall are subject to being washed off the leaves and onto the soil.

Foliar fertilizer application provides a more timely and immediate method for delivery of specific nutrients at critical stages of plant growth. Foliar nutrition programs are therefore valuable supplements to soil applications. As indicated previously, foliar feeding is not intended to replace soil-applied fertilizer of macronutrients [nitrogen (N), potassium (K) and phosphorus (P)].

Foliar applications of macronutrients can, however, be alternatively applied in sufficient quantities to influence both yield and fruit quality. Citrus trees can have a large part of the annual N requirements met through foliar applications. Foliar applications of other macronutrients [calcium (Ca), magnesium (Mg) and sulfur (S)] and micronutrients [zinc (Zn), manganese (Mn), copper (Cu), boron (B) and molybdenum (Mo)] have proven to be an excellent means for satisfying citrus tree requirements.

APPLICATION ADVANTAGES

Because fertilizer applications to the soil can be subjected to undesirable processes such as leaching, runoff and being tied up in the soil in unavailable forms, foliar applications of nutrients have been designed to be an integral component of overall tree nutrition programs. Foliar applications are used in other situations to help trees

through short but critical periods of nutrient demand, such as vegetative growth, bud differentiation, fruit set and fruit growth.

Foliar application of nutrients is of great importance when the root system is unable to keep up with crop demand or when the soil has a history of problems that inhibit normal nutrient uptake. Foliar nutrition is proven to be useful under prolonged periods of wet conditions, dry conditions, calcareous soil, cold weather or any other condition that decreases the tree's ability to take up nutrients when there is a demand. Foliar feeding may be effectively utilized when a nutritional deficiency is diagnosed. Foliar application is absolutely the quickest method of getting the most nutrients into plants. However, if the deficiency can be observed on the tree, the crop has already lost some potential yield.

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CONSIDER ENIRONMENTAL CONDITIONS

While foliar feeding has many advantages, it can burn leaves at certain rates under certain environmental conditions. It is important, therefore, to foliar feed within some established guidelines. There are a number of plant, soil and environmental conditions that can increase the chances of causing leaf burn due to foliar fertilizer application.

For example, a tree under stress is generally more susceptible to damage. Stressful conditions include dry winds, disease infection and unfavorable soil conditions. The environmental conditions at the time of application are also important factors. Applications when the weather is hot (above 85 F) should be avoided. This means that during warm seasons, applications should be made in the morning or evening when

the temperature is right, wind is minimal and the stomates on citrus leaves are open, allowing leaves to efficiently exchange water and air.

OTHER FACTORS

Nutrient absorption is increased when spray coverage reaches the undersides of the leaves where the stomates are located. Favorable results from foliar feeding are most likely to occur when the total leaf area is large. Foliar applications of micronutrients, with the exception of iron, are more effective and efficient when the spring, summer and fall new flush leaves are about fully expanded.

Additionally, applications should be at least two weeks apart to give the tree sufficient time to metabolize the nutrients and deal with the added osmotic stress. To be efficient and to avoid crop damage, dilute solutions of nutrient formulations are recommended. Highly concentrated sprays, especially those including salt-based fertilizers, have the potential to cause leaf burn and/or drop.

Another important factor when applying foliar nutrients is to ensure that the pH of the spray solution is in the proper range (between 5.5 and 6.5). This is particularly important in areas where water quality is poor.

FERTILIZER SOURCES

In order to enhance uptake and thus the effectiveness of any foliar application, N should be added to the solution. Urea may be the most suitable N source for foliar applications due to its low salt index and high solubility in comparison with other N sources. Urea has been shown to stimulate absorption of other nutrients by increasing the permeability of leaf tissue. However, the urea utilized in foliar sprays should be low in biuret content (0.2% or less) to avoid leaf burn.

Other sources of N can be obtained from ammonium polyphosphates, ammoniated ortho-phosphates, potassium nitrate, calcium nitrate and ammonium thiosulfate. These sources, when utilized at low rates of foliar application, are excellent supplemental N carriers with minimal foliage burn side effects. Triazone N has been shown to significantly reduce leaf burn and enhance foliar-absorbed N compared with urea, nitrate, and ammoniacal N sources.

Foliar-applied fertilizer to citrus trees

The use of a combination of poly and ortho-phosphates has been shown to lessen leaf burn and aid in leaf phosphate absorption. Phosphites have also been found useful, safe and not phytotoxic as foliar sprays on citrus trees. Potassium polyphosphates, potassium hydroxide, potassium nitrate and potassium thiosulfate sources combine both low salt index and high solubility characteristics.

Foliar application of Ca, Mg, S, Zn, Mn, Cu, B and Mo can be highly effective to satisfy nutrient requirements. However, there can be difficulties associated with leaf tissue absorption and translocation of calcium, magnesium, boron and molybdenum. Choosing the correct fertilizer sources for these nutrients can be critical.

INTERACTIONS AND INCOMPATIBILITIES

Be careful about possible chemical interactions among foliar fertilizers. Some materials are incompatible and should not be mixed. They may create precipitates that tie up and make some nutrients unavailable and/or clog spray nozzles. Many product labels warn of such incompatibilities. If there is no specific packaging information, small quantities of the materials should be mixed with water in a jar and shaken. If there is no precipitate, there should be no problem.

Foliar fertilization can sometimes be combined with pesticide application. However, timing conflicts and material incompatibilities can sometimes make combining such sprays unwise. Be sure to read all product labels and do the jar test if uncertain.

WHAT WORKS

Foliar applications of low biuret urea at 12 to 14 gallons or at 53 to 60 pounds (24 to 28 pounds N) per acre or phosphite (PO_3) at 3 pints (60% P) to 2 quarts (26% P) per acre in late December/early January (6 to 8 weeks before bloom) have been demonstrated to increase flowering, fruit set and fruit production. Postbloom foliar applications of potassium nitrate or mono-potassium phosphate at 8 pounds K_2O per acre have also been found to increase fruit yield and fruit size.

Foliar spray applications of 3 to 5 pounds per acre of Mg, Mn, Zn and Cu, and 0.25 to 0.50 pound per acre of B and Mo are also recommended on each of the three major flushes of citrus trees to prevent nutrient deficiencies, cope with HLB and improve production. Sulfate forms are less expensive, and nitrate forms appear to facilitate the uptake of micronutrients.